TÜVRheinland®
Precisely Right.

RF Exposure Exhibit

EUT Name: Wireless Residential Gateway

Model No.: 5268AC

CFR 47 Part 2.1093

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1 RF Exposure

1.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this calculation is declared by the manufacturer, and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

1.2 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm$_2$)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	…	…	1.0	6
300 - 1500	…	…	f/300	6
1500 - 100,000	…	…	5	6
(B)Limits For General Population / Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/ f^2)	30
30–300	27.5	0.037	0.2	30
300 - 1500	…	…	f/1500	30
1500 - 100,000	…	…	1.0	30

F = Frequency in MHz

* = Plane-wave equivalent power density

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1.3   EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

1.4   Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual. So, this device is classified as a Mobile Device.

1.5   Test Results

1.5.1   Antenna Gain
The highest antenna gain at 2.4GHz range was +3.7 dBi or 2.34 (numeric)
The maximum 5GHz directional antenna gain was +8.08 dBi or 6.43 (numeric).

1.5.2   Output Power into Antenna & RF Exposure value at distance 20cm

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Frequency (MHz)	Highest Power (dBm)	Max. Ant. Gain (dbi)	Power Density (mW/cm^2)	Limit (mW/cm^2)	Result
2400-2483.5	+25.89	3.70	0.1811	1.0	Pass
5150-5250	+14.89	8.08	0.0394	1.0	Pass
5250-5350	+22.76	8.08	0.2416	1.0	Pass
5470-5725	+22.23	8.08	0.2139	1.0	Pass
5725-5850	+28.06	8.08	0.8188	1.0	Pass

Note: 1. 2.4GHz range is uncorrelated and not beamforming; therefore, the highest antenna was used.
2. If the both radios, 2.4GHz and 5GHz, are active, the maximum power density is 0.9999 mW/cm^2; which is less than 1.0 mW/cm^2.

1.5.3   Sample Calculation
The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$
Where;
Pd = power density in mW/cm2
Pout = output power to antenna in mW
G = 6.31; gain of antenna in linear scale
$\pi \approx 3.1416$
R = 20cm; distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).